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Terms	Documents
(lithium and battery and (carbon or carbonaceous)).clm. and (differential ADJ thermal adj analysis).clm.	6

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IBM Technical Disclosure Bulletins

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(lithium and battery and (carbon or carbonaceous)).clm. and (differential ADJ thermal adj analysis).clm.

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<u>DB Name</u>	<u>Query</u>	<u>Hit Count</u>	<u>Set Name</u>
USPT	(lithium and battery and (carbon or carbonaceous)).clm. and (differential ADJ thermal adj analysis).clm.	6	<u>L3</u>
USPT	(lithium and battery and (carbon or carbonaceous)).clm. and (differential ADJ thermal adj analysis)	21	<u>L2</u>
USPT	(lithium and battery and (carbon or carbonaceous)).clm. and (thermal adj analysis)	23	<u>L1</u>

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L3: Entry 1 of 6

File: USPT

Mar 18, 1997

US-PAT-NO: 5612155

DOCUMENT-IDENTIFIER: US 5612155 A

TITLE: Lithium ion secondary battery

DATE-ISSUED: March 18, 1997

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Takami; Norio	Yokohama	N/A	N/A	JPX
Ohsaki; Takahisa	Yokohama	N/A	N/A	JPX
Asami; Yoshiaki	Niza	N/A	N/A	JPX

US-CL-CURRENT: 429/331; 429/231.8, 429/233, 429/332

## CLAIMS:

What is claimed is:

1. A lithium ion secondary battery comprising:

a positive electrode;

a negative electrode comprising a collector and carbon fibers held to said collector for absorbing and desorbing lithium ions;

a separator arranged between said positive electrode and said negative electrode; and

a nonaqueous electrolyte,

wherein said carbon fibers have a radial orientation from an axis of the fibers, and at least 50 vol % of all carbon fibers are arranged such that an angle between an axis of each carbon fiber and a surface of said collector is 45.degree. or less.2. The secondary battery according to claim 1, wherein said angle is 15.degree. or less.3. The secondary battery according to claim 1, wherein carbon fibers having said angle occupy at least 70 vol % of all carbon fibers.4. The secondary battery according to claim 1, wherein said carbon fibers have an average fiber length of 10 to 100 .mu.m, an average fiber diameter of 1 to 20 .mu.m, and an average aspect ratio of 2 to 10 which is represented by a ratio of a fiber length to a fiber diameter.5. The secondary battery according to claim 1, wherein said carbon fibers have an irregularity in orientation of the graphite crystal.6. The secondary battery according to claim 1, wherein said negative electrode further comprises fine carbon particles of any shape other than a fiber-shape.7. The secondary battery according to claim 6, wherein said fine carbon particles are spherical carbon particles or thin-strip carbon particles.8. The secondary battery according to claim 6, wherein a mixing ratio of said fine carbon particles to said carbon fibers is 2 to 30 wt %.9. The secondary battery according to claim 1, wherein said carbon fibers have a peak intensity ratio P.sub.101 /P.sub.100 of a (101) diffraction peak P.sub.101 to a (100) diffraction peak P.sub.100 according to an X-ray diffraction method to be not less than 1.2.10. The secondary battery according to claim 1, wherein said carbon fibers have a layer spacing (d.sub.002) of (002) planes of a graphite structure of 0.3354 to 0.3370 nm, which is measured by X-ray diffraction, a length La of a crystallite in an a-axis direction of not less than 60 nm, and a length Lc of a crystallite in a c-axis direction of not less than 40 nm.11. The secondary battery according to claim 1, wherein said carbon fibers have

an exothermic peak of not less than 800.degree. C. in a differential thermal analysis.

12. The secondary battery according to claim 1, wherein said negative electrode is formed by preparing a suspension containing said carbon fibers, coating the suspension on said collector, drying the resultant, and performing multistage pressing two to five times at a desired pressure.

13. The secondary battery according to claim 1, wherein an active material for said positive electrode is a lithium-containing compound.

14. The secondary battery according to claim 1, wherein said nonaqueous electrolyte comprises a solvent mixture and a lithium salt dissolved in said solvent mixture, and said solvent mixture comprises ethylene carbonate and at least one nonaqueous solvent having a melting point lower than the ethylene carbonate and a donor number of not more than 18.

15. The secondary battery according to claim 14, wherein said nonaqueous solvent comprises a compound selected from the group consisting of propylene carbonate, dimethyl carbonate, methyl ethyl carbonate and diethyl carbonate.

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L3: Entry 2 of 6

File: USPT

Oct 1, 1996

US-PAT-NO: 5561005

DOCUMENT-IDENTIFIER: US 5561005 A

TITLE: Secondary battery having non-aqueous electrolyte

DATE-ISSUED: October 1, 1996

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Omaru; Atsuo	Kanagawa	N/A	N/A	JPX
Fujita; Shigeru	Tokyo	N/A	N/A	JPX
Yokoyama; Keiichi	Chiba	N/A	N/A	JPX
Hihara; Akio	Chiba	N/A	N/A	JPX

US-CL-CURRENT: 429/326

## CLAIMS:

What is claimed is:

1. A secondary battery having a non-aqueous electrolyte comprising: a negative electrode consisting essentially of a resin binder and a non-graphitic carbonaceous material capable of doping and undoping lithium ions as an active anode material, said non-graphitic carbonaceous material exhibiting an interplanar distance of the (002) plane of 0.37 nm and greater, a true density of 1.7 g/cm.<sup>sup.3</sup> and less, and an exothermic peak at 700.degree. C. and lower observed in differential thermal analysis in an air current; a positive electrode including a composite oxide of lithium and a transition metal as an active cathode material; and a non-aqueous electrolyte including a dissolved electrolyte in a non-aqueous solvent, the solvent including from about 20% to about 80% by volume of a mixture of methylethyl carbonate and dimethyl carbonate wherein the volume ratio of methylethyl carbonate and dimethyl carbonate is from about 1:9 to about 8:2, respectively, and a high dielectric constant propylene carbonate solvent.
2. The secondary battery having a non-aqueous electrolyte as is claimed in claim 1, wherein diethyl carbonate is present in the non-aqueous solvent in an amount of from about 1 to 20 vol %.
3. A secondary battery as defined in claim 1, wherein the dissolved electrolyte is selected from the group consisting of: LiPF.<sub>sub.6</sub>, LiClO.<sub>sub.4</sub>, LiAsF.<sub>sub.6</sub> and LiBF.<sub>sub.4</sub> and the dissolved electrolyte is present in an amount of from about 0.1 to about 3 moles per liter of non-aqueous solvent.
4. A secondary battery as defined in claim 1, wherein the composite oxide is LiCoO.<sub>sub.2</sub>.
5. A secondary battery having a non-aqueous electrolyte comprising: a negative electrode consisting essentially of a graphitic carbonaceous material capable of doping and undoping lithium ions as an active anode material, said graphitic carbonaceous material exhibiting an interplanar distance of the (002) plane of 0.340 nm and smaller, a crystallite size of 14.0 nm and greater in C-axis, and a true density of 2.1 g/cm.<sup>sup.3</sup> and greater; a positive electrode including a composite oxide of lithium and a transition metal as an active cathode material; and a non-aqueous electrolyte including a dissolved electrolyte in a non-aqueous solvent, the solvent including from about 20% to about 80% by volume of a mixture of methylethyl carbonate and dimethyl carbonate wherein the volume ratio of methylethyl carbonate and dimethyl carbonate is from about 1:9 to about 8:2, respectively, and a high dielectric constant ethylene carbonate

about 8:2, respectively, and a high dielectric constant ethylene carbonate solvent.

6. A secondary battery as defined in claim 5, wherein the dissolved electrolyte is selected from the group consisting of:  $\text{LiPF}_6$ ,  $\text{LiClO}_4$ ,  $\text{LiAsF}_6$  and  $\text{LiBF}_4$  and the dissolved electrolyte is present in an amount of from about 0.1 to about 3 moles per liter of non-aqueous solvent.

7. A secondary battery as defined in claim 5, wherein the composite oxide is  $\text{LiCoO}_2$ .

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L3: Entry 4 of 6

File: USPT

Aug 23, 1994

US-PAT-NO: 5340670

DOCUMENT-IDENTIFIER: US 5340670 A

TITLE: Lithium secondary battery and method of manufacturing carbonaceous material for negative electrode of the battery

DATE-ISSUED: August 23, 1994

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Takami; Norio	Yokohama	N/A	N/A	JPX
Satoh; Asako	Yokohama	N/A	N/A	JPX
Ohsaki; Takahisa	Yokohama	N/A	N/A	JPX

US-CL-CURRENT: 429/331; 423/445R, 423/448, 429/231.5, 429/231.8, 429/330, 429/332

## CLAIMS:

What is claimed is:

1. A lithium secondary battery comprising:  
a positive electrode housed in a case;  
a negative electrode housed in said case and containing a carbonaceous material which has an exothermic peak at not less than 700.degree. C. when measured by a differential thermal analysis, and an intensity ratio P.sub.101 /P.sub.100 of a (101) diffraction peak P.sub.101 to a (100) diffraction peak P.sub.100 of a graphite structure, obtained by X-ray diffraction analysis, of 0.7 to 2.2, and absorbs and desorbs lithium ions;  
a separator housed in said case so as to be arranged between said positive and negative electrodes; and  
a nonaqueous electrolyte contained in said case.
2. The secondary battery according to claim 1, wherein said carbonaceous material has an interplanar distance (d.sub.002) of (002) planes of a graphite structure, obtained by X-ray diffraction analysis, 0.336 to 0.338 nm, a ratio La/Lc of a length La in an a-axis direction to a length Lc in a c-axis direction of 1.3 to 2.5, and a length La in the a-axis direction of not more than 100 nm.
3. The secondary battery according to claim 1, wherein said carbonaceous material consists of fibrous powders which are distributed at a ratio of not less than 90 vol % within the range of a length of 0.5 to 100 .mu.m and have an average diameter of 1 to 30 .mu.m.
4. The secondary battery according to claim 1, wherein said carbonaceous material consists of spherical particles which are distributed at a ratio of not less than 90 vol % within the range of a particle size of 1 to 100 .mu.m and have an average particle size of 1 to 80 .mu.m.
5. The secondary battery according to claim 1, wherein said carbonaceous material has an exothermic peak at not less than 800.degree. C. when measured by a differential thermal analysis, and an intensity ratio P.sub.101 /P.sub.100 of a (101) diffraction peak P.sub.101 to a (100) diffraction peak P.sub.100 of a graphite structure, obtained by X-ray diffraction analysis, of 0.8 to 1.8.
6. The secondary battery according to claim 1, wherein said nonaqueous electrolyte consists of a solvent mixture containing ethylene carbonate and at least one nonaqueous solvent, which has a melting point lower than the melting point of ethylene carbonate and a donor number of not more than 18, and a lithium salt dissolved in said solvent mixture.

7. The secondary battery according to claim 6, wherein said nonaqueous solvent having a donor number of not more than 18 is at least one material selected from the group consisting of dimethyl carbonate, diethyl carbonate, propylene carbonate, .gamma.-butyrolactone, acetonitrile, nitromethane, nitrobenzene, ethyl acetate, toluene, xylene, and methyl acetate.

8. The secondary battery according to claim 6, wherein said lithium salt is at least one material selected from the group consisting of lithium perchlorate (LiClO<sub>4</sub>.sub.4), lithium phosphate hexafluoride (LiPF<sub>6</sub>.sub.6), lithium borofluoride (LiBF<sub>4</sub>.sub.4), arsenolithium hexafluoride (LiAsF<sub>6</sub>.sub.6), lithium trifluoromethanesulfonate (LiCF<sub>3</sub>SO<sub>3</sub>.sub.3), and lithium bisfluoromethylsulfonylimide (LiN(CF<sub>3</sub>SO<sub>2</sub>)<sub>2</sub>.sub.2).

9. The secondary battery according to claim 6, wherein said lithium salt is dissolved within the range of 0.5 to 2.0 mols/l in said solvent mixture.

10. A lithium secondary battery comprising:

a positive electrode housed in a case and containing, as an active material, a lithium metal compound which includes at least one metal selected from the group consisting of cobalt, nickel, manganese, vanadium, titanium, molybdenum, and iron;

a negative electrode housed in said case and containing a carbonaceous material which has an interplanar distance d<sub>002</sub> of (002) planes of a graphite structure, obtained by X-ray diffraction analysis, of not more than 0.340 nm, and absorbs and desorbs lithium ions;

a separator housed in said case so as to be arranged between said positive and negative electrodes; and

a nonaqueous electrolyte contained in said case,

wherein a ratio of a thickness of said positive electrode to a thickness of said negative electrode is 2:1 to 0.9:1, and a ratio of a weight per unit area of said positive electrode to a weight per unit volume of said negative electrode is 4:1 to 2:1.

11. The secondary battery according to claim 10, wherein said lithium metal compound is at least one material selected from the group consisting of lithium-cobalt oxide, lithium-nickel oxide, and lithium-manganese oxide.

12. The secondary battery according to claim 10, wherein said positive electrode comprises a metal foil having a thickness of 10 to 40 .mu.m and consisting of aluminum, stainless steel, or nickel, as a collector for holding said active material.

13. The secondary battery according to claim 10, wherein said carbonaceous material has an exothermic peak at not less than 700.degree. C. when measured by a differential thermal analysis and an intensity ratio P<sub>sub.101</sub>/P<sub>sub.100</sub> of a (100) diffraction peak P<sub>sub.101</sub> to a (100) diffraction peak P<sub>sub.100</sub> of a graphite structure, obtained by X-ray diffraction analysis, of 0.7 to 2.2.

14. The secondary battery according to claim 10, wherein said negative electrode comprises a metal foil having a thickness of 5 to 30 .mu.m and consisting of copper, stainless steel, or nickel, as a collector for holding said carbonaceous material.

15. The secondary battery according to claim 10, wherein said nonaqueous electrolyte has a composition in which a lithium salt is dissolved in a nonaqueous solvent.

16. A lithium secondary battery comprising:

a positive electrode housed in a case;

a negative electrode housed in said case and containing a carbonaceous material which has an exothermic peak at not less than 700.degree. C. when measure by a differential thermal analysis, and a sulfur content of not more than 1,000 ppm, and absorbs and desorbs lithium ions;

a separator housed in said case so as to be arranged between said positive and negative electrodes; and

a nonaqueous electrolyte contained in said case and consisting of a solvent mixture containing ethylene carbonate and at least one nonaqueous solvent, which has a melting point lower than the melting point of ethylene carbonate and a donor number of not more than 18, and a lithium salt dissolved in said solvent mixture.

17. The secondary battery according to claim 16, wherein said carbonaceous material has an average La of a crystallite in an a-axis direction of a graphite structure, which is derived from a diffraction peak of a (110) plane obtained by X-ray diffraction analysis, of 20 to 100 nm.

18. The secondary battery according to claim 16, wherein said carbonaceous material has a content of each metal element of 0 to 50 ppm, a silicon content of 0 to 50 ppm, and a nitrogen content of 0 to 1,000 ppm.

19. The secondary battery according to claim 16, wherein said nonaqueous

solvent having a donor number of not more than 18 is at least one material selected from the group consisting of dimethyl carbonate, diethyl carbonate, propylene carbonate, gamma.-butyrolactone, acetonitrile, nitromethane, nitrobenzene, ethyl acetate, toluene, xylene, and methyl acetate.

20. The secondary battery according to claim 16, wherein said lithium salt is at least one material selected from the group consisting of lithium perchlorate (LiClO.sub.4), lithium phosphate hexafluoride (LiPF.sub.6), lithium borofluoride (LiBF.sub.4), arsenolithium hexafluoride (LiAsF.sub.6), lithium trifluoromethansulfonate (LiCF.sub.3 SO.sub.3), and lithium bisfluoromethylsulfonylimide (LiN(CF.sub.3 SO.sub.2).sub.2).

21. The secondary battery according to claim 16, wherein said lithium salt is dissolved within the range of 0.5 to 2.0 mols/l in said solvent mixture.

22. A method of manufacturing a carbonaceous material for a negative electrode of a battery, comprising the steps of:

carbonizing through a heat treatment at least one material selected from coke and one of fibrous and spherical carbon materials obtained from a pitch having anisotropy, thereby forming a carbon product;

pulverizing said carbon product into a carbon product powder; and

graphitizing said carbon product powder through a heat treatment at not less than 2,000.degree. C.

23. The method according to claim 22, wherein said pitch having anisotropy contains not less than 95 vol % of an anisotropic pitch.

24. The method according to claim 22, wherein said fibrous material consists of short fibers having a length of 100 to 1,000 .mu.m.

25. The method according to claim 22, wherein said carbon product has an interplanar distance d.sub.002 of (002) planes, obtained by X-ray diffraction analysis, of 0.344 to 0.380 nm.

26. The method according to claim 22, wherein said carbon product has an orientation.

27. The method according to claim 22, wherein after being carbonized, said fibrous material is so pulverized as to be distributed at a ratio of not less than 90 vol % within the range of a length of 0.5 to 100 .mu.m and have an average diameter of 1 to 30 .mu.m.

28. The method according to claim 22, wherein the heat treatment in the carbonization step is performed at a temperature of 600.degree. C. to 2,000.degree. C.

29. The method according to claim 22, wherein the graphitization step is performed in an atmosphere containing chlorine gas.

30. The method according to claim 22, wherein said pitch having anisotropy is a mesophase pitch.



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L3: Entry 5 of 6

File: USPT

Mar 8, 1994

US-PAT-NO: 5292601

DOCUMENT-IDENTIFIER: US 5292601 A

TITLE: Nonaqueous electrolyte secondary battery

DATE-ISSUED: March 8, 1994

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Sugeno; Naoyuki	Fukushima	N/A	N/A	JPX
Anzai; Masanori	Fukushima	N/A	N/A	JPX
Nagaura; Toru	Fukushima	N/A	N/A	JPX

US-CL-CURRENT: 429/332; 429/232

## CLAIMS:

What is claimed is:

1. A nonaqueous electrolyte secondary battery comprising:  
a negative electrode including a carbonaceous material capable of doping and de-doping lithium, the carbonaceous material selected from the group consisting of furan resins and petroleum pitches and having a spacing of (002) planes of not less than 3.70 angstroms and any exothermic peak at temperatures not lower than 700.degree. C. when determined differential thermal analysis, the carbonaceous material further including at least one of 0.2 to 5.0 wt % of phosphorus and 0.1 to 2.0 wt % of boron, a positive electrode made of an active material which includes a Li-containing metal complex oxide of the general formula  $\text{Li}_{\text{sub}x}\text{MO}_{\text{sub}2}$ , wherein M represents at least one member selected from the group consisting of Co, Ni and Mn and 0.5.ltoreq.X.ltoreq.1, and a nonaqueous electrolyte which contains an electrolyte and an organic solvent therefor, the organic solvent being a mixed solvent of propylene carbonate and at least one member selected from the group consisting of diethyl carbonate and dipropyl carbonate.

**WEST****End of Result Set**

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L3: Entry 6 of 6

File: USPT

Sep 14, 1993

US-PAT-NO: 5244757

DOCUMENT-IDENTIFIER: US 5244757 A

TITLE: Lithium secondary battery

DATE-ISSUED: September 14, 1993

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Takami; Norio	Kanagawa	N/A	N/A	JPX
Ohasaki; Takahisa	Kanagawa	N/A	N/A	JPX

US-CL-CURRENT: 429/336; 429/231.8, 429/337, 429/338, 429/339, 429/341

## CLAIMS:

We claim:

1. A lithium secondary battery, comprising:

a vessel;

a positive electrode containing an active material housed in the vessel;

a lithium ion conductive electrolyte in the vessel; anda negative electrode arranged in the vessel containing carbonaceous material spherical particles as active materials that absorb and discharge lithium ions, the carbonaceous material spherical particles containing a graphitoid layered structure part and a turbulence-layered structure part, fine structures of the carbonaceous material spherical particle being arranged in point-orientation.2. The battery of claim 1, wherein the mean value of the (002) face distance (d.sub.002) in the carbonaceous material spherical particle is 0.337 nm to 0.380 nm.3. The battery of claim 1, wherein the mean size of the crystal lattice (LC) along the C-axis in the spherical particle is 1 nm to 25 nm.4. The battery of claim 1, wherein the Raman spectrum ratio R.sub.1 /R.sub.2 of the spherical particles is in the range of 0.5 to 1.5 where:

R.sub.1 is a peak value at 1,360.sup.-1 cm, and

R.sub.2 is a peak value at 1,580.sup.-1 cm.

5. The battery of claim 1, wherein the atomic ratio of hydrogen to carbon (H/C) in the spherical particles is less than 0.15.6. The battery of claim 1, wherein the average size of the spherical particles is in the range of 0.5 .mu.m to 100 .mu.m.7. The battery of claim 1, wherein the ratio of the minor radius and the major radius of the spherical particles is at least 1/10.8. The battery of claim 1, wherein the spherical particles have an exothermic peak at 900.degree. C. or less measured by differential thermal analysis.9. A lithium secondary battery, comprising:

a vessel;

a positive electrode containing an active material housed in the vessel;

a lithium ion conductive electrolyte in the vessel; and,a negative electrode arranged in the vessel containing carbonaceous material fibers as active materials that absorb and discharge lithium ions, thecarbonaceous material fibers containing a graphitoid layered structure part and a turbulence-layered structure part both having fine structures arranged in at least one of (a) a lamellar type structure and (b) a Brooks-Taylor type structure defined by a combination of lamellar and radiant type structures or by a radial crystallite orientation surface property and a random central

structure.

10. The battery of claim 9, wherein the mean value of the (002) face distance (d.sub.002) in the carbonaceous material fibers is 0.337 nm to 0.380 nm.

11. The battery of claim 9, wherein the mean size of the crystal lattice (Lc) along the C-axis direction in the fibers is 1 nm to 25 nm.

12. The battery of claim 9, wherein the Raman spectrum ratio R.sub.1 /R.sub.2 of the fibers is in the range of 0.5 to 1.5 where;

R.sub.1 is a peak value at 1,360.sup.-1 cm, and

R.sub.2 is a peak value at 1,580.sup.-1 cm.

13. The battery of claim 9, wherein the atomic ratio of hydrogen/carbon (H/C) of the fibers is less than 0.15.

14. The battery of claim 9, wherein the average size of the diameter of the fibers is in the range of 1 .mu.m to 100 .mu.m and the average size of the length of the fibers is in the range of 1 .mu.m to 200 .mu.m.

15. The battery of claim 9, wherein the fibers have an exothermic peak at 900.degree. C. or less measured by differential thermal analysis.

16. The battery of claim 1 or claim 9 alternatively, wherein the lithium ion conductive electrolyte contains a solvent including ethylene carbonate, propylene carbonate and at least one compound selected from the group consisting of 1,2-dimethoxyethane, 1,2-diethoxyethane, diethyl carbonate, dimethoxymethane, .gamma.-butyrolactone and tetrahydrofuran, and an electrolytic salt selected from the group consisting of lithium borofluoride, lithium phosphate hexafluoride and lithium trifluorometasulfonate.

17. The battery of claim 16, wherein the ratio of at least one compound in the solvent is 40 volume % or less.

18. The battery of either of claims 1 or 9, wherein the lithium ion conductive electrolyte contains at least one nonaqueous solvent selected from a group consisting of ethylene carbonate, propylene carbonate, diethyl carbonate .gamma.-butyrolactone, sulpholan, acetonitrile, 1,2-dimethoxyethane, 1,2-diethoxyethane, 1,3-dimethoxypropane, dimethylether, tetrahydrofuran and 2-methyltetrahydrofuran.

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Search Results - Record(s) 1 through 6 of 6 returned.

☐ 1. Document ID: US 5612155 A

L3: Entry 1 of 6

File: USPT

Mar 18, 1997

US-PAT-NO: 5612155

DOCUMENT-IDENTIFIER: US 5612155 A

TITLE: Lithium ion secondary battery

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 2. Document ID: US 5561005 A

L3: Entry 2 of 6

File: USPT

Oct 1, 1996

US-PAT-NO: 5561005

DOCUMENT-IDENTIFIER: US 5561005 A

TITLE: Secondary battery having non-aqueous electrolyte

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 3. Document ID: US 5451477 A

L3: Entry 3 of 6

File: USPT

Sep 19, 1995

US-PAT-NO: 5451477

DOCUMENT-IDENTIFIER: US 5451477 A

TITLE: Non-aqueous liquid electrolyte secondary battery

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 4. Document ID: US 5340670 A

L3: Entry 4 of 6

File: USPT

Aug 23, 1994

US-PAT-NO: 5340670

DOCUMENT-IDENTIFIER: US 5340670 A

TITLE: Lithium secondary battery and method of manufacturing carbonaceous material for negative electrode of the battery

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 5. Document ID: US 5292601 A

L3: Entry 5 of 6

File: USPT

Mar 8, 1994

US-PAT-NO: 5292601

DOCUMENT-IDENTIFIER: US 5292601 A

TITLE: Nonaqueous electrolyte secondary battery

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KMIC	Draw Desc	Image
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☐ 6. Document ID: US 5244757 A

L3: Entry 6 of 6

File: USPT

Sep 14, 1993

US-PAT-NO: 5244757

DOCUMENT-IDENTIFIER: US 5244757 A

TITLE: Lithium secondary battery

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KMIC	Draw Desc	Image
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Terms	Documents
(lithium and battery and (carbon or carbonaceous)).clm. and (differential ADJ thermal adj analysis).clm.	6

Documents, starting with Document:

**Display Format:**

**WEST**[Generate Collection](#)**Search Results - Record(s) 1 through 10 of 21 returned.**☐ 1. Document ID: US 6096453 A

L2: Entry 1 of 21

File: USPT

Aug 1, 2000

US-PAT-NO: 6096453

DOCUMENT-IDENTIFIER: US 6096453 A

TITLE: Polymeric thin-film reversible electrochemical charge storage devices

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 2. Document ID: US 6083646 A

L2: Entry 2 of 21

File: USPT

Jul 4, 2000

US-PAT-NO: 6083646

DOCUMENT-IDENTIFIER: US 6083646 A

TITLE: Non-aqueous electrolyte secondary battery and method for producing cathode material

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 3. Document ID: US 6001507 A

L2: Entry 3 of 21

File: USPT

Dec 14, 1999

US-PAT-NO: 6001507

DOCUMENT-IDENTIFIER: US 6001507 A

TITLE: Non-aqueous electrolyte secondary battery

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 4. Document ID: US 5919589 A

L2: Entry 4 of 21

File: USPT

Jul 6, 1999

US-PAT-NO: 5919589

DOCUMENT-IDENTIFIER: US 5919589 A

TITLE: Rechargeable battery

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 5. Document ID: US 5916707 A

L2: Entry 5 of 21

File: USPT

Jun 29, 1999

US-PAT-NO: 5916707

DOCUMENT-IDENTIFIER: US 5916707 A

TITLE: Nonaqueous-electrolyte secondary battery and battery case for limiting expansion thereof due to internal pressure

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 6. Document ID: US 5888670 A

L2: Entry 6 of 21

File: USPT

Mar 30, 1999

US-PAT-NO: 5888670

DOCUMENT-IDENTIFIER: US 5888670 A

TITLE: Lithium secondary battery and electrodes therefor and method of forming the same

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 7. Document ID: US 5783326 A

L2: Entry 7 of 21

File: USPT

Jul 21, 1998

US-PAT-NO: 5783326

DOCUMENT-IDENTIFIER: US 5783326 A

TITLE: Nonaqueous electrolyte secondary battery

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 8. Document ID: US 5773168 A

L2: Entry 8 of 21

File: USPT

Jun 30, 1998

US-PAT-NO: 5773168

DOCUMENT-IDENTIFIER: US 5773168 A

TITLE: Nonaqueous electrolyte secondary battery and method for manufacturing the same

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 9. Document ID: US 5725968 A

L2: Entry 9 of 21

File: USPT

Mar 10, 1998

US-PAT-NO: 5725968

DOCUMENT-IDENTIFIER: US 5725968 A

TITLE: Alkaline ion-absorbing/desorbing carbon material electrode material  
for secondary battery using the carbon material and lithium secondary  
battery using the electron material

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 10. Document ID: US 5716732 A

L2: Entry 10 of 21

File: USPT

Feb 10, 1998

US-PAT-NO: 5716732

DOCUMENT-IDENTIFIER: US 5716732 A

TITLE: Anode material and method of manufacturing the same

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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Terms	Documents
(lithium and battery and (carbon or carbonaceous)).clm. and (differential ADJ thermal adj analysis)	21

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Documents, starting with Document:

**11****Display Format:** **TI****Change Format**



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Search Results - Record(s) 11 through 20 of 21 returned.

☐ 11. Document ID: US 5702845 A

L2: Entry 11 of 21

File: USPT

Dec 30, 1997

US-PAT-NO: 5702845

DOCUMENT-IDENTIFIER: US 5702845 A

TITLE: Secondary battery using lithium

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 12. Document ID: US 5612155 A

L2: Entry 12 of 21

File: USPT

Mar 18, 1997

US-PAT-NO: 5612155

DOCUMENT-IDENTIFIER: US 5612155 A

TITLE: Lithium ion secondary battery

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 13. Document ID: US 5591545 A

L2: Entry 13 of 21

File: USPT

Jan 7, 1997

US-PAT-NO: 5591545

DOCUMENT-IDENTIFIER: US 5591545 A

TITLE: Carbon material and method for producing same

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 14. Document ID: US 5561005 A

L2: Entry 14 of 21

File: USPT

Oct 1, 1996

US-PAT-NO: 5561005

DOCUMENT-IDENTIFIER: US 5561005 A

TITLE: Secondary battery having non-aqueous electrolyte

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 15. Document ID: US 5538810 A

L2: Entry 15 of 21

File: USPT

Jul 23, 1996

US-PAT-NO: 5538810  
DOCUMENT-IDENTIFIER: US 5538810 A  
TITLE: Corrosion resistant ceramic materials

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 16. Document ID: US 5451477 A

L2: Entry 16 of 21

File: USPT

Sep 19, 1995

US-PAT-NO: 5451477  
DOCUMENT-IDENTIFIER: US 5451477 A  
TITLE: Non-aqueous liquid electrolyte secondary battery

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 17. Document ID: US 5437945 A

L2: Entry 17 of 21

File: USPT

Aug 1, 1995

US-PAT-NO: 5437945  
DOCUMENT-IDENTIFIER: US 5437945 A  
TITLE: Secondary battery having non-aqueous electrolyte

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 18. Document ID: US 5340670 A

L2: Entry 18 of 21

File: USPT

Aug 23, 1994

US-PAT-NO: 5340670  
DOCUMENT-IDENTIFIER: US 5340670 A  
TITLE: Lithium secondary battery and method of manufacturing carbonaceous material for negative electrode of the battery

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 19. Document ID: US 5312611 A

L2: Entry 19 of 21

File: USPT

May 17, 1994

US-PAT-NO: 5312611  
DOCUMENT-IDENTIFIER: US 5312611 A  
TITLE: Lithium secondary battery process for making carbonaceous material for a negative electrode of lithium secondary battery

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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☐ 20. Document ID: US 5292601 A

L2: Entry 20 of 21

File: USPT

Mar 8, 1994

US-PAT-NO: 5292601

DOCUMENT-IDENTIFIER: US 5292601 A

TITLE: Nonaqueous electrolyte secondary battery

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Draw Desc	Image
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Terms	Documents
(lithium and battery and (carbon or carbonaceous)).clm. and (differential ADJ thermal adj analysis)	21

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Search Results - Record(s) 21 through 21 of 21 returned.

☐ 21. Document ID: US 5244757 A

L2: Entry 21 of 21

File: USPT

Sep 14, 1993

US-PAT-NO: 5244757

DOCUMENT-IDENTIFIER: US 5244757 A

TITLE: Lithium secondary battery

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	QWIC	Draw-Desc	Image
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Terms	Documents
(lithium and battery and (carbon or carbonaceous)).clm. and (differential ADJ thermal adj analysis)	21

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